

What is claimed is:

1. A plasticating apparatus comprising:

a barrel having an inlet and an outlet;

5 a rotatable screw disposed within and cooperating with
an inner wall of said barrel, said screw adapted for
plasticating resinous material fed into said barrel through
said inlet, said screw comprising;

10 a longitudinal axis with a feed section, a barrier
melting section and a metering section disposed sequentially
downstream along said screw axis, a reorientation section is
disposed between the barrier melting section and the metering
section;

15 said screw including a main helical flight having a push
side and a trailing side, said main flight forming a feed
channel at said inlet of said screw;

20 a barrier flight disposed in said barrier melting
section intermediate said main flight, said main flight
having a constant pitch in the barrier melting section, said
barrier flight and said main flight dividing said barrier
melting section into a melt channel and a solids channel
extending helically side by side, said barrier flight having
helical threads with a diameter less than the diameter of

helical threads of said main flight, so that melt material flows over said barrier flight and into said melt channel, whereby solid material conveyed along said barrier melting section is positioned adjacent said trailing side and whereas melt material conveyed along said barrier melting section is positioned adjacent said push side;

said barrier flight discontinuing at a terminal end of said barrier melting section;

said main helical flight passing into the reorientation section makes a rotation of at least 540° about said screw axis at a pitch less than the pitch of the main flight in the barrier melting section, said melt channel and said solids channel in said barrier melting section merging into a substantially uniform reorientation channel in said reorientation section thereby forcing solid plastic material conveyed along said reorientation section toward said push side of the main flight; and

a secondary flight disposed in said metering section intermediate said main flight, and said main flight continuing into said metering section from the reorientation section, whereby solid material conveyed along said metering section is positioned primarily adjacent said push side of

the main flight and whereas melt material conveyed along said metering section is positioned primarily adjacent said trailing side of the main flight.

5 2. The apparatus of claim 1, wherein said main flight has a substantially constant diameter throughout said metering section and said barrier flight has a substantially constant diameter throughout said barrier melting section.

10 3. The apparatus of claim 1, wherein said main flight has a thread width greater than said secondary flight in said metering section.

15 4. The apparatus of claim 1, wherein said barrier flight has a diameter substantially the same as said secondary flight.

20 5. The apparatus of claim 4, wherein said barrier flight has a width substantially the same as said secondary flight.

 6. The apparatus of claim 5, wherein said metering

section is a multi-channel undulating metering section.

7. A plasticating apparatus comprising:

a barrel having an inlet and an outlet;

5 a rotatable screw having a longitudinal axis, the screw being disposed within and cooperating with an inner wall of said barrel, said screw adapted for plasticating resinous material fed into said barrel through said inlet, said screw comprising;

10 a feed section, a barrier melting section, a reorientation section and a multi-channel undulating metering section located sequentially downstream along said screw axis;

15 said screw including a main helical flight having a push side and a trailing side, said main flight forming a feed channel at said inlet of said screw at the feed section;

20 a barrier flight disposed in said barrier melting section intermediate said main flight, said barrier flight and said main flight dividing said barrier melting section into a melt channel and a solids channel extending helically side by side, said barrier flight having helical threads with a diameter less than the diameter of helical threads of said

main flight so that melt material flows over said barrier flight and into said melt channel, whereby solid material conveyed along said barrier melting section is positioned adjacent said trailing side of said main flight and whereas melt material conveyed along said barrier melting section is positioned adjacent said push side of said main flight;

said barrier flight terminating at a terminal end of said barrier melting section;

said main helical flight traversing through the reorientation section having a rotation at least 360° about the longitudinal axis of said screw, said main flight including a decreased pitch beginning substantially adjacent to the terminal end of said barrier melting section and resuming said decreased pitch through said reorientation section, said solids channel and said melt channel merge into a substantially uniform reorientation channel at a location substantially coinciding with said decreased pitch of said main flight thereby forcing solid plastic material conveyed along said reorientation section toward said push side of the main flight; and

said main flight passing into said metering section, a secondary flight being disposed in said metering section

intermediate said main flight whereby solid material conveyed
along said metering section is positioned primarily adjacent
said push side of the main flight and whereas melt material
conveyed along said metering section is positioned primarily
adjacent said trailing side of the main flight.

8. The apparatus of claim 7, wherein said solids
channel and said melt channel maintain substantially constant
widths through said barrier melting section, said solids
channel narrows at a position along said screw coinciding
with said decreased pitch of the main flight.

9. The apparatus of claim 7, wherein the main helical
flight passing into the reorientation section makes a
rotation of at least 720° about said screw axis.

10. The apparatus of claim 7, wherein the main helical
flight passing into the reorientation section makes a
rotation at least 1440° about said screw axis.

11. The apparatus of claim 7, wherein the main helical
flight of the reorientation section having a helix angle θ of

approximately 19.5°.

12. The apparatus of claim 11, wherein the helix angle
θ of the main helical flight of the reorientation section and
the melting section are substantially equal.

13. A plasticating apparatus comprising:

a barrel having an inlet and an outlet;

a rotatable screw having a longitudinal axis, the screw
being disposed within and cooperating with an inner wall of
said barrel, said screw adapted for plasticating resinous
material fed into said barrel through said inlet, said screw
comprising;

a feed section, a barrier melting section, a
reorientation section and a multi-channel undulating metering
section located sequentially downstream along said screw
axis;

said screw including a main helical flight having a push
side and a trailing side, said main flight forming a feed
channel at said inlet of said screw at the feed section;

a barrier flight disposed in said barrier melting
section intermediate said main flight, said barrier flight

and said main flight dividing said barrier melting section into a melt channel and a solids channel extending helically side by side, said barrier flight having helical threads with a diameter less than the diameter of helical threads of said main flight so that melt material flows over said barrier flight and into said melt channel, whereby solid material conveyed along said barrier melting section is positioned adjacent said trailing side of said main flight and whereas melt material conveyed along said barrier melting section is positioned adjacent said push side of said main flight;

said barrier flight terminating at a terminal end of said barrier melting section;

said main helical flight traversing through the reorientation section having a rotation at least 540° about the longitudinal axis of said screw, said main flight including a decreased pitch beginning substantially adjacent to the terminal end of said barrier melting section and resuming said decreased pitch through said reorientation section wherein the main flight has a helix angle θ between 15° and 21° , said solids channel and said melt channel merge into a substantially uniform reorientation channel at a location substantially coinciding with said decreased pitch

of said main flight thereby forcing solid plastic material conveyed along said reorientation section toward said push side of the main flight; and

5 said main flight passing into said metering section, a secondary flight being disposed in said metering section intermediate said main flight whereby solid material conveyed along said metering section is positioned primarily adjacent said push side of the main flight and whereas melt material conveyed along said metering section is positioned primarily adjacent said trailing side of the main flight.

10 14. The apparatus of claim 13, wherein the helix angle θ of the main helical flight of the reorientation section and the melting section are substantially equal.

15 15. The apparatus of claim 14, wherein said barrier flight has a diameter substantially the same as said secondary flight.

20 16. The apparatus of claim 15, wherein said barrier flight has a width substantially the same as said secondary flight.